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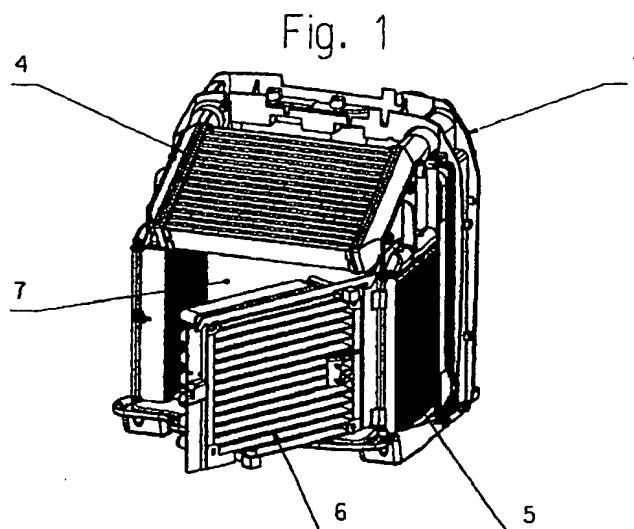
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(54) Vehicle cooling radiator arrangement

(57) An arrangement of radiators (2-6) for a utility vehicle, eg an agricultural tractor, comprising three or more cooling radiators which together define a chamber (7), optionally with some of the walls formed by perforated plates instead of radiator elements. One of the

radiator elements may be pivotally mounted with respect to the others to provide access to the chamber. The arrangement of radiators may be mounted on a common support (1).



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## Description

[0001] The invention relates to a arrangement of three or more cooling radiators for a utility vehicle, such as a agricultural tractor.

[0002] Powerful utility vehicles, such as agricultural tractors, for example, require a number of radiators in order to re-cool the working media, such as coolant water for the engine transmission oil ad hydraulic oil amongst others, as they become heated during use. These days, it is common practice to provide the requisite radiators in a parallel arrangement one after the other so that the coolant air flows through radiators. However, there are certain disadvantages to this layout. Arranging the radiators one after the other results in a high resistance to air flow which, apart from making it necessary to provide a disproportionately powerful fan, can also cause lead to a interruption in the flow, which results in the radiators becoming overheated. The lower temperature differential available to the radiators also makes it necessary to provide radiators of a larger size. In addition, ay dirt which gets into radiator fins, particularly those of the radiators at the rear, is very difficult or totally impossible to remove completely without dismantling the radiators. The presence of dirt poses the risk of local overheating in the radiators.

[0003] An objective of the invention is to provide an arrangement of three or more radiators of the generic type outlined above which is efficient, easy to maintain and not susceptible to failure.

[0004] According to the invention, an arrangement of cooling radiators is provided as set out in Claim 1 hereto.

[0005] The advantage of this arrangement is that the flow resistance is reduced when compared to three parallel radiators one after the other, which means that smaller radiators can be used to achieve the same cooling effect. Access to the radiators is also easier.

[0006] Preferably, the arrangement also has the features set out in Claim 2. In this arrangement, it is ensured that there are no "short circuits" of air flow resulting in localised hot spots on any of the radiators. Preferably access is provided means of the features set out in Claim 3.

[0007] Other preferable features are set out in the dependent Claims.

[0008] In general, the arrangement specifically described herein provides an inner chamber surrounded on most sides by radiators, which makes for ready access to the sides of the radiators on the interior, provided one of the radiators is pivotably mounted or detachable. Any dirt which has become stuck to the radiator fins can be removed easily using compressed air for example.

[0009] In addition, the radiator arrangement reduces the overall flow resistance in the radiators, resulting in low flow losses, thus providing a system of radiators which operates satisfactorily, even with a conventional

fan, and is not susceptible to failure. This can largely be ascribed to the fact that relatively large cooling surfaces can be provided by arranging the radiators in the layout proposed by the invention, allowing the air to flow at a low rate and the fact that the entire coolant air induced, which does not contain any outside air, has to flow through two radiators only. Not to be overlooked, however, is the fact that a part of the dirt which might be contained in the air flowing through the radiators at the front is left in the inner chamber, which not only means that the efficiency of the rear radiator remains unaffected for a longer time but also the under-pressure prevailing in the inner chamber during this time is that required to induce a sufficient quantity of coolant air through the radiators connected at the front end.

[0010] In one practical arrangement of the invention, the radiators are mounted on a common radiator support. With this design, the radiator system can be assembled beforehand. This means that the entire radiator system can be provided as a unit which is pre-assembled by the radiator manufacturer and fitted as part of the assembly process by the vehicle manufacturer. Advantageous features of the radiator support are set out in some of the following dependent claims.

[0011] In the case of cooling systems in which not all the possible locations for radiators will be used, for example because the vehicle does not have a hydraulic system and does not therefore require the radiator for the hydraulic oil, a practical solution is to replace the radiators arranged to front of the bracket with air permeable plates, whose resistance to the passage of air corresponds to that of the radiators which they have replaced. The under-pressure generated in the inner chamber due to the fan will then remain the same as it would be in a cooling system with a radiator for hydraulic oil ad hence also the through-put of air through the system.

[0012] An embodiment of the invention will now be described in more detail below with reference to drawings. Of these:

Figure 1 is a perspective view of a cooling system seen from the front;

Figure 2 is a side view of the cooling system of Figure, and

Figure 3 is an exploded diagram of the cooling system of Figure 1.

[0013] The cooling system illustrated in the drawings is designed to be provided as a pre-assembled unit which can be mounted and secured directly onto a vehicle frame, not illustrated, in front of a fan.

[0014] This unit has a radiator support 1, on which several radiators are arranged. These are a rear water radiator designated by reference 2, a gear oil radiator 3, a booster air radiator 4, a combined radiator 5 for hydraulic oil and fuel as well as a condenser 6 for the air-conditioning system. Depending on the vehicle and

the application for which it will be used, radiators which are not required can be replaced by radiators for other media or by air permeable plates. This being the case, the replacement plates can be designed in such a way that they have the same resistance to through-flow as the radiator which they replace.

[0015] Being the radiator with the largest surface area in this embodiment, the water radiator 2 is mounted in the interior of a bracket 1b, which is secured at the rear end region of the radiator support 1 so as to stand upright on the lower part 1a thereof. A fan deflector guide 1c is fixed to the bracket 1b behind the water radiator 2. All the other radiators are arranged in front of the bracket 1b in the longitudinal direction of the vehicle. Arranged the farthest forward, parallel with and at a long distance from the water radiator 2 is the condenser 6. The region between the water radiator 2 and the condenser 6 is delimited on the one side by the radiator 3, on the other side by the radiator 5 and at the top by the radiator 4, thereby forming an inner chamber 7. At their bracket-ends, the radiators 3 to 5 are secured to the bracket 1b at the peripheral regions and are joined to one another at their adjacent peripheral regions. The radiators 3, 5 at the sides are provided with plug elements 3a, 5a on the underside thereof and are supported in matching counter elements on the lower portion 1a. In order to fix the plug connections, the radiators 3, 5 are braced at their front end region with the lower portion 1a by means of long, vertical retaining screws 8.

[0016] Various points at which the radiators 3 to 5 abut with one another and with the radiator support 1 are designed so as to be air-tight due to matching contours of the radiators and/or by the use of appropriate sealing materials, so that air can enter the radiators via the inner chamber 7 only. As can be seen, the radiators 3, 5 at the sides are provided with matching formed plates 3b, 5b for this purpose, which fill the region between these radiators and the radiator 4 extending down towards the front on a level with the condenser 6.

[0017] The condenser 6 is not joined to either of the adjacent radiators 3 to 5. Instead, it is secured onto a frame 9 which can be pivoted by means of lateral joints 10 about one of the retaining screws 8, in order to provide ready access to the inner chamber 7 for maintenance work. The other retaining screw 8 is used to secure the condenser 6 in the closed position in which it is sealed against outside air by means of known locking elements 11, 12.

[0018] Lastly, in a modification of this embodiment, two or more sides of the chamber 7 are provided by a single, angled or curved radiator.

### Claims

1. An arrangement of 3 or more cooling radiators in a utility vehicle such as an agricultural tractor characterised in that the radiators (2-6) together define or

partially define a chamber (7).

2. An arrangement of radiators as claimed in Claim 1 characterised in that the said chamber (7) is bounded on all sides by radiators (2-6) or other wall members.

3. An arrangement as claimed in Claim 1 or Claim 2 characterised in that at least one of the radiators (2-6) or wall members is releasably mounted to provide access to the chamber (7).

4. An arrangement as claimed in Claim 3 characterised in that the said releasably mounted radiator or wall member is pivotably mounted with respect to the radiators or other radiators.

5. An arrangement as claimed in Claim 1 characterised in that the radiators (2-6) and/or wall members are mounted on a common support (1).

6. An arrangement as claimed in Claim 5 characterised in that the support (1) consists of a base part (1a) and a bracket (1b) upstanding from the region of one end of the base part (1a).

7. An arrangement as claimed in Claim 6 characterised in that a water cooling radiator (2) is mounted with an airtight seal in the said upstanding bracket (1b).

8. An arrangement as claimed in Claim 3 or Claim 4 and in Claim 5, 6 or 7, characterised in that, with the exception of the said releasably or pivotally mounted radiator (6), all the said cooling radiators are sealingly joined to each other and/or to the cooler support (1) to form a rigid unit.

9. An arrangement as claimed in Claim 6 or any claim dependent thereon characterised in that the cooling radiators (3, 5) defining two opposed sides of the chamber (7) are retained on the base portion (1a) by means of a plug and socket connection together with retaining screws (8).

10. An arrangement as claimed in Claim 2 or any claim dependent thereon characterised in that some or all of any said wall members comprise air permeable plates, having a predetermined resistance to air flow therethrough.

11. An agricultural tractor including an arrangement of cooling radiators as claimed in any preceding claim.

12. An agricultural tractor as claimed in Claim 10 having an engine hood which slopes downwardly towards the front thereof and in which the said cooling arrangement is enclosed at the forward end

thereof, the cooling radiator arrangement including front and rear substantially parallel planar radiators, the major faces thereof facing substantially in the direction of movement of the tractor.

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13. A tractor as claimed in Claim 12 when dependent upon Claim 6 characterised in that the rearmost of the said two parallel radiators comprises the said water cooler (2).

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Fig. 1

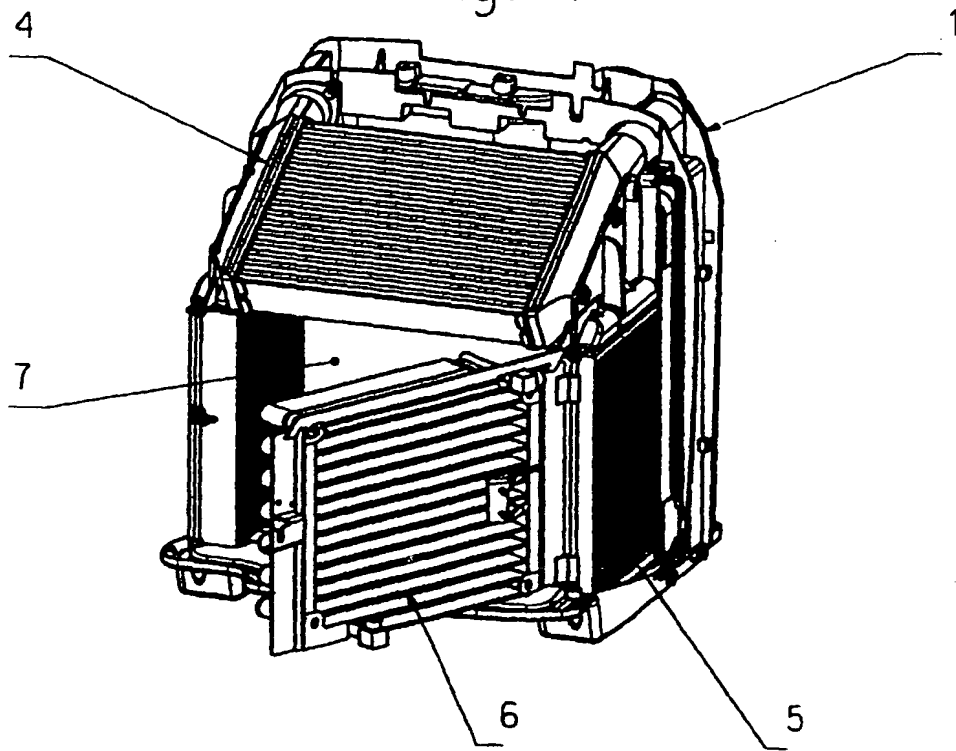


Fig. 2

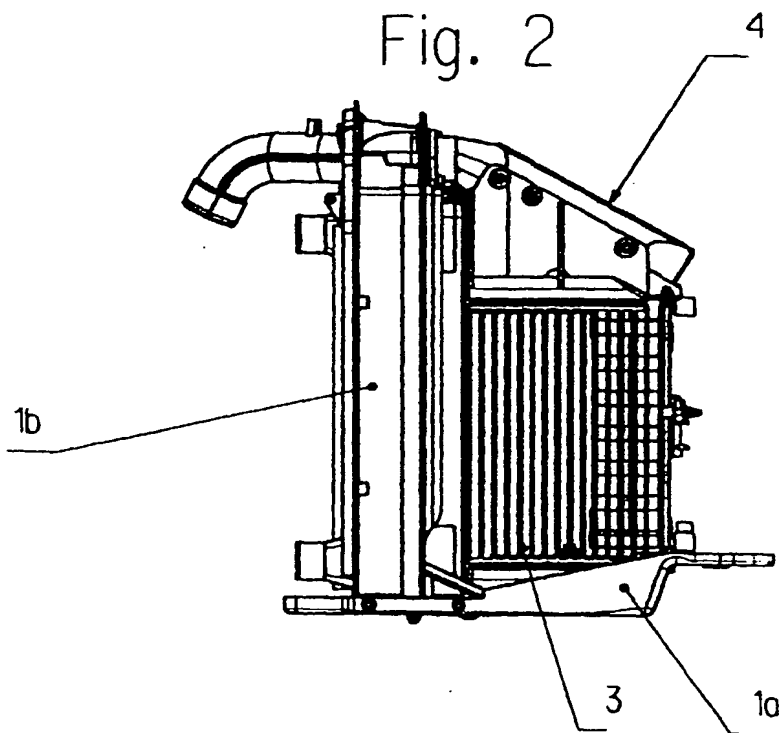
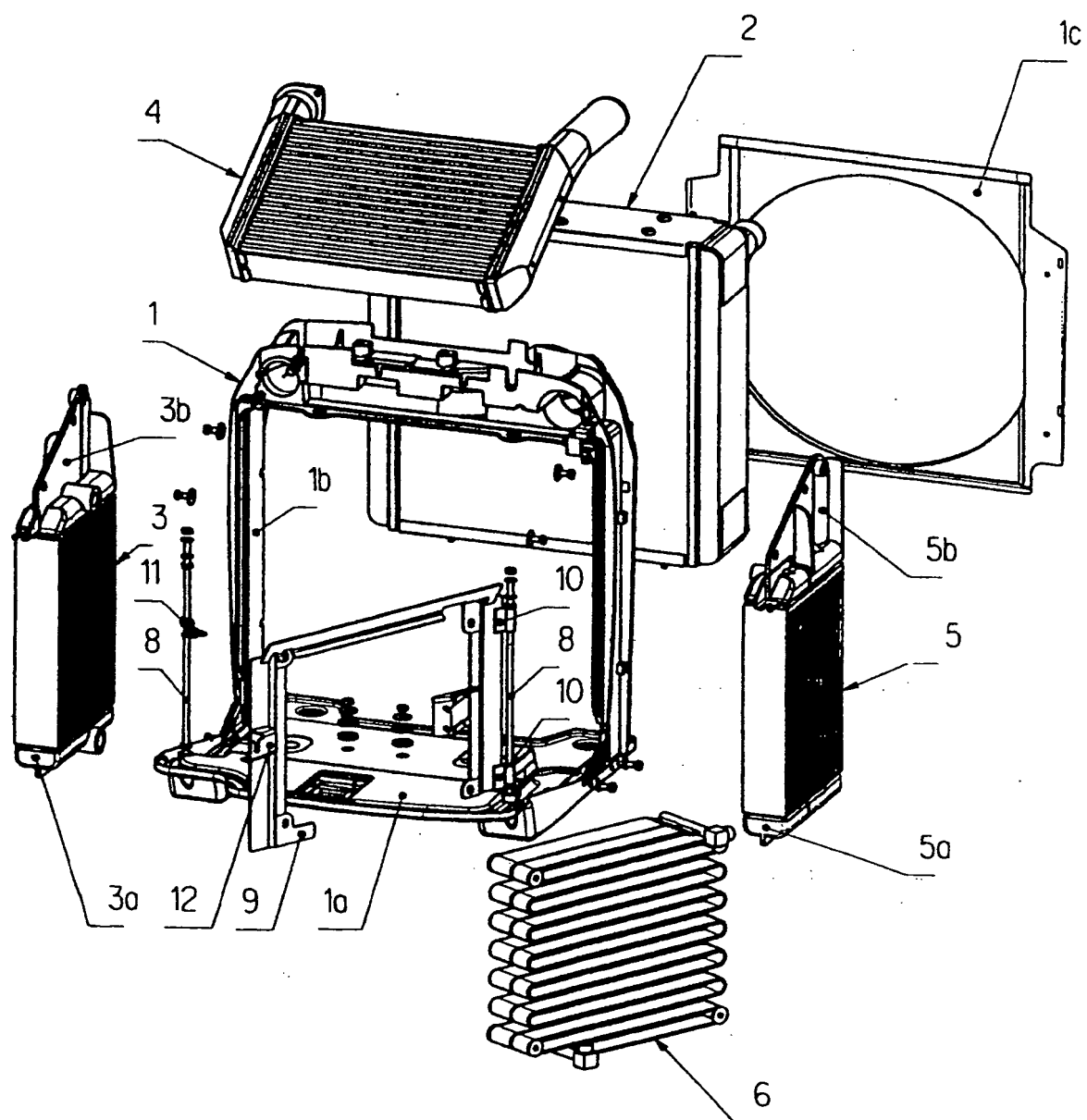
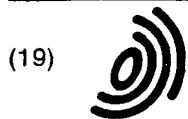


Fig. 3





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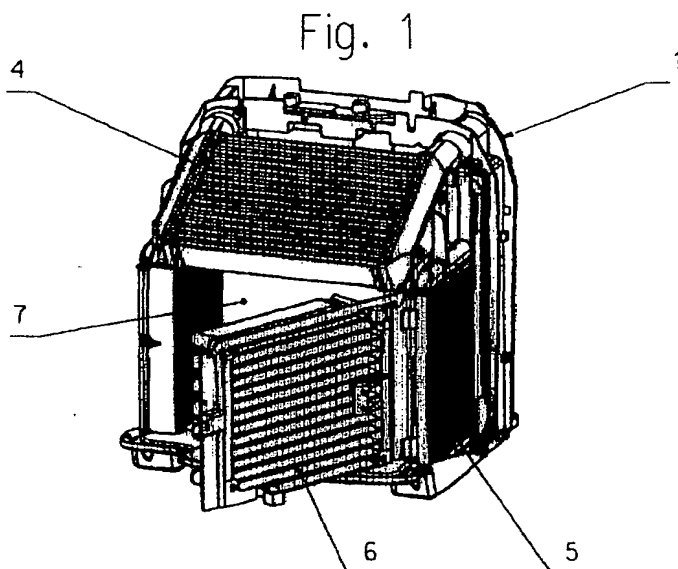
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(54) **Vehicle cooling radiator arrangement**

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# EUROPEAN SEARCH REPORT

Application Number  
EP 99 10 7736

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	DE 295 04 867 U (LIEBHERR WERK BISCHOFSHOFEN) 11 July 1996 (1996-07-11)	1,2,5-8, 11	B60K11/04
Y	* the whole document *	3,4,9	
Y	EP 0 515 924 A (KLOECKNER HUMBOLDT DEUTZ AG) 2 December 1992 (1992-12-02)	3,4	
Y	* abstract; figures *		
Y	DE 39 26 569 C (MERCEDES-BENZ AG) 7 February 1991 (1991-02-07)	9	
Y	* abstract; figures *		
X	DE 31 18 539 A (MASCHF AUGSBURG NUERNBERG AG) 2 December 1982 (1982-12-02)	1,2,5-8	
	* abstract; figures *		
P,X	DE 197 24 728 A (LAENGERER & REICH GMBH & CO ;SCANIA CV AB (SE)) 25 February 1999 (1999-02-25)	1,2,5-8, 10,11	
	* abstract; figure 1 *		
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B60K F01P
Place of search		Date of completion of the search	Examiner
THE HAGUE		10 October 2001	Wagner, H
CATEGORY OF CITED DOCUMENTS			
<p>X : particularly relevant if taken alone</p> <p>Y : particularly relevant if combined with another document of the same category</p> <p>A : technological background</p> <p>O : non-written disclosure</p> <p>P : intermediate document</p> <p>T : theory or principle underlying the invention</p> <p>E : earlier patent document, but published on, or after the filing date</p> <p>D : document cited in the application</p> <p>L : document cited for other reasons</p> <p>&amp; : member of the same patent family, corresponding document</p>			

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**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on  
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Patent document cited in search report		Publication date	Patent family member(s)		Publication date
DE 29504867	U	11-07-1996	DE	29504867 U1	11-07-1996
EP 0515924	A	02-12-1992	DE	4122512 A1	03-12-1992
			DE	59204172 D1	07-12-1995
			EP	0515924 A1	02-12-1992
			US	5234051 A	10-08-1993
DE 3926569	C	07-02-1991	DE	3926569 C1	07-02-1991
			FR	2650789 A1	15-02-1991
			GB	2234720 A , B	13-02-1991
			IT	1241501 B	17-01-1994
DE 3118539	A	02-12-1982	DE	3118539 A1	02-12-1982
DE 19724728	A	25-02-1999	DE	19724728 A1	25-02-1999

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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